

# START

0021870

JUN 30 1992

## ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 158869

2. To: (Receiving Organization) Record File		3. From: (Originating Organization)		4. Related EDT No.: NA	
5. Proj./Prog./Dept./Div.: Environmental Restoration		6. Cog. Engr.: R. D. Belden		7. Purchase Order No.: NA	
8. Originator Remarks: Release to record file.				9. Equip./Component No.: NA	
				10. System/Bldg./Facility: NA	
11. Receiver Remarks:				12. Major Assm. Dwg. No.: NA	
				13. Permit/Permit Application No.: NA	
				14. Required Response Date: NA	

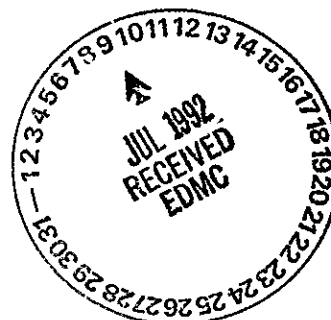
15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Impact Level	Reason for Transmittal	Originator Disposition	Receiver Disposition
1.	WHC-SD-EN-T1-039		Q	Evaluation of Hexavalent Chromium for 300-FF-1 and 300-FF-5 Operable Units	4			

16. KEY					
Impact Level (F)		Reason for Transmittal (G)		Disposition (H) & (I)	
1, 2, 3, or 4 (see MRP 5.43)		1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)		1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged	

17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)									
(G)	(H)	(J) Name (K) Signature (L) Date (M) MSIN				(J) Name (K) Signature (L) Date (M) MSIN			
Reason	Disp.								
2	1	Cog.Eng.	R. D. Belden	R. D. Belden	6/23/92				
2	1	Cog. Mgr.	R. A. Carlson	R. A. Carlson	6/23/92				

18. Signature of EDT Originator R. D. Belden 6/23/92		19. Authorized Representative Date for Receiving Organization		20. Cognizant/Project Engineer's Manager R. A. Carlson 6/23/92		21. DOE APPROVAL (if required) Ltr. No. <input type="checkbox"/> Approved <input type="checkbox"/> Approved w/comments <input type="checkbox"/> Disapproved w/comments	
--	--	---	--	--	--	--	--

BD-7400-172-2 (07/91) GEF097



BD-7400-172-1 (02/89)

## SUPPORTING DOCUMENT

1. Total Pages 26

## 2. Title

Evaluation of Hexavalent Chromium for 300-FF-1 and 300-FF-5 Operable Units

## 3. Number

WHC-SD-EN-TI-039

## 4. Rev No.

0

## 5. Key Words

APPROVED FOR  
PUBLIC RELEASE

## 6. Author

Name: R. D. Belden

*R.D. Belden*  
SignatureOrganization/Charge Code  
81222/PC3AA/PC2AA

## 7. Abstract

6/19/92 N. Solis

8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform, direct, or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed.

PATENT STATUS - This document copy, since it is transmitted in advance of patent clearance, is made available in confidence solely for use in performance of work under contracts with the U.S. Department of Energy. This document is not to be published nor its contents otherwise disseminated or used for purposes other than specified above before patent approval for such release or use has been secured, upon request, from the Patent Counsel, U.S. Department of Energy Field Office, Richland, WA.

DISCLAIMER - This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

## 10.

## RELEASE STAMP

OFFICIAL RELEASE  
BY WHC

DATE JUN 30 1992

*Sta. 21*

## 9. Impact Level 4

## CONTENTS

1.0	INTRODUCTION . . . . .	1
2.0	GROUNDWATER DATA . . . . .	1
3.0	SOILS ANALYSIS . . . . .	4
4.0	CONCLUSIONS . . . . .	5
5.0	REFERENCES . . . . .	6

## FIGURE

1	Master Well Map . . . . .	3
---	---------------------------	---

## APPENDIX

A	Well Result Report . . . . .	A-1
---	------------------------------	-----

## TABLES

1	300-FF-5 Groundwater Samples . . . . .	1
2	Levels of Cr Analyzed in 300-FF-5 Groundwater . . . . .	2

9 2 1 2 5 3 5 1 7 3 3

## 1.0 INTRODUCTION

In order to resolve the issue regarding the existence or nonexistence of Cr(VI) in the 300-FF-1 and 300-FF-5 operable units, a close look at the sample data from representative wells in and around 300-FF-1 was taken. Samples were taken from 20 wells and a total of 686 samples were taken during the period between June 17, 1985, and December 18, 1991.

## 2.0 GROUNDWATER DATA

The samples were analyzed using Inductively Coupled Plasma (ICP) Emission Spectrometry. Analysis was done on both filtered and unfiltered samples. There were samples taken early in the sampling period, which were not filtered. It is presumed that this was prior to the realization of the need to do both.

Table 1 shows a breakdown of filtered and unfiltered samples for which Cr analysis was done.

Table 1. 300-FF-5 Groundwater Samples.

<u>Well</u>	<u>Unfiltered</u>	<u>Filtered</u>	<u>Total</u>
3-1-10	13	12	25
3-1-11	12	20	32
3-1-12	13	12	25
3-1-13	13	16	29
3-1-14	13	13	26
3-1-15	14	14	28
3-1-16A	16	17	33
3-1-16B	16	16	32
3-1-17A	14	21	35
3-1-17B	12	11	23
3-1-18A	13	12	35
3-1-7	33	14	47
3-2-1	32	18	50
3-3-10	42	17	59
3-3-7	33	18	51
3-3-9	5	5	10
3-4-1	32	18	50
3-4-11	13	13	26
3-4-7	42	18	60
3-8-1	<u>10</u>	<u>10</u>	<u>20</u>
Totals	391	295	686

Appendix A provides a detailed listing of the samples and the results of the analysis. Figure 1 shows the location of the wells sampled in relation to the 300 Area process disposal facilities and the Columbia River.

Table 2 shows a breakdown of the lab results for Cr for the entire sample lot.

Table 2. Levels of Cr Analyzed in 300-FF-5 Groundwater.

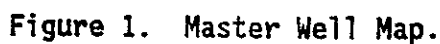
<u>µg/L (ppb)</u>	<u>Unfiltered</u>	<u>Filtered</u>	<u>Total</u>
Cr undetected	351	295	646
Cr < 50 ppb	39	0	39
Cr ≥ 50 ppb	<u>1</u>	<u>0</u>	<u>1</u>
Totals	391	295	686

The location of wells that had detectable Cr can be seen in Figure 1.

Several observations can be made by looking at the breakdown in Table 1. First, only 40 samples out of 391 unfiltered samples (10.2%) had Cr above the method detection limits. By looking at the distribution of the 40 samples (either on Figure 1 or in Appendix A), it is apparent that there is not a concentration of Cr in any particular area or well, nor is there any particular well that shows a consistent presence of Cr in its samples. The 40 samples are divided up among 16 different wells.

Second, only one sample exceeded the safe drinking water limit of 50 ppb. This was a sample taken on December 16, 1991, in well 3-1-7. The level of Cr for this sample was 73 ppb, which, although it exceeds the drinking water limit, does not exceed the freshwater aquatic life standard (100 ppb) set by the U.S. Environmental Protection Agency (EPA) (Quality Criteria For Water, EPA 1976).

Third, the Cr is tied up with the suspended particulates. There were no filtered samples for which Cr was detectable. Of the 40 unfiltered samples in which Cr was detected, 33 have a matching filtered sample. All of the filtered samples came out below detection limits.



### 3.0 SOILS ANALYSIS

Since Cr is tied up with the suspended material, the argument can be made that it is in the form of Cr(III) and not the toxic form Cr(VI). Detection of Cr(VI) in drinking water and groundwater from wastes disposed through recharge basins, diffusion wells, or landfills suggests this form of Cr is not effectively sorbed by the soil (Griffin et al. 1977; Adriano 1986). Since the filtered samples indicate no detectible Cr, it would appear that this Cr is effectively sorbed by the soil.

Adriano (1986) states that soluble Cr may be converted to insoluble forms when added to soils. One process is via reduction of soluble and relatively toxic Cr(VI) to Cr(III). If the Cr is tied up with the suspended particles and can be removed by filtering, it is not soluble and must therefore be in the reduced form of Cr(III). Adriano (1986) goes on to say the results indicate that although Cr(III) could be oxidized to Cr(VI) in soil, this is probably not all that common. On the other hand, when Cr(VI) is added to soil it can be expected to rapidly reduce to Cr(III). Therefore, Cr in most soils probably occurs as Cr(III).

To illustrate the increased potential for Cr(III) versus Cr(VI) to adsorb to particles one can look at the Distribution Coefficients for the two phases. Baes and Sharp (1983) discuss the Distribution Coefficients,  $K_d$ , where  $K_d$  is defined by the following equation:

$$K_d = \frac{C_s}{C_w}$$

where

$C_s$  is the concentration of the solid phase  
 $C_w$  is the concentration in  $H_2O$

Cr(VI) has a Distribution Coefficient between 1.2 and 1,800, whereas Cr(III) is in a much higher range of 470 to 150,000. Clearly, the Cr(VI) is less likely to adhere to particles and, hence more mobile and likely to be transported during infiltration. Conversely, the Cr(III) would be expected to adsorb more readily to particles, be less mobile and more capable of being filtered out of the groundwater.

To further strengthen the argument, Cary et al. (1977) and Adriano (1986) found that Cr(VI) was reduced to Cr(III) at a faster rate in acidic soils versus basic soils. Young and Fruchter (1991) give a list of acids disposed in the 300 Area Process Ponds. It makes sense that the Cr(VI) still remaining in the ponds during periods of acidic discharge would have a greater likelihood to reduce to Cr(III).

The pH is not the only contributing factor. Reduction of Cr(VI) in soil can be enhanced by the presence of organic material (Cary et al. 1977; Bartlett and Kimble, 1976; James and Bartlett, 1983; Adriano 1986). Young and Fruchter (1991) have indicated that organic chemicals were also discharged to the North and South Ponds, thus increasing the potential for the Cr(VI) to be reduced.

It is feasible that at the time of deposition, the conditions might be such that at least some of the Cr(VI) would not be reduced to Cr(III). As a result of Cr(VI) being soluble and because of the design of the process ponds and the process trenches (i.e., all liquids will infiltrate into the groundwater system and then directly into the river), any Cr(VI) that was not reduced would have gone immediately to the river. Young and Fruchter (1991) reveal that elevated Cr levels were detected in the seep water approximately 7 days after the Cr was discharged to the pond. A logical conclusion from this analysis is that a significant portion of the Cr discharged is no longer onsite.

#### 4.0 CONCLUSION

It is well documented that Cr(VI) was disposed in the 300-FF-1 Process Sewer system during intermittent periods for a great many years. This disposal was discontinued several years ago. The question is whether or not the Cr currently being detected in the 300-FF-1 and 300-FF-5 soil and water samples is Cr(VI) or Cr(III).

The comparison of the unfiltered samples and the filtered samples demonstrates that removal of the suspended material by filtering will remove the Cr to below detection limits. This implies that the Cr is tied up with the suspended material and is no longer insoluble. Due to the high potential for Cr(III) to adsorb to particles and the extreme unlikelihood for soluble Cr(VI) to attach to suspended particles, the Cr assayed in the samples cannot be Cr(VI).

Since Cr(VI) is soluble and hence much more mobile, it is expected that if there were any Cr(VI) that did not reduce to Cr(III) that it would have long since been transported to the river via the groundwater and is no longer onsite.

It should also be noted that the amount of Cr detected in the samples was below the drinking water standard (50 ppb) for 99.7% of the unfiltered samples. Only one sample was over 50 ppb and that sample was still under the freshwater aquatic life standard.

Therefore, it can be concluded that the Cr found in the soils of 300-FF-1 and in the groundwater of 300-FF-5 will cause no significant risk to human health or the environment.



## 5.0 REFERENCES

- Adriano, D. C., 1986, *Trace Elements in the Terrestrial Environment*, 156-177, Springer-Verlag, New York.
- Baes, C. F. III and R. D. Sharp, 1983, *Journal of Environmental Quality* 12(1):17-28.
- Bartlett, R. J. and J. M. Kimble, 1976, *Journal of Environmental Quality* 5:383-386.
- Cary, E. E., W. H. Allaway and O. E. Olson, 1977, *Journal of Agricultural and Food Chemistry* 25:305-309.
- EPA, 1976, *Quality Criteria for Water*, U.S. Environmental Protection Agency, Washington, D.C.
- Griffin, R. A., A. K. Au, and R. R. Frost, 1977, *Journal of Environmental Science and Health* A12(8):431-449.
- James, B. R. and R. J. Bartlett, 1983, *Journal of Environmental Quality* 12:177-181.
- Young, J. S. and J. S. Fruchter, 1991, *Addendum to Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase 1 Remedial Investigations*, EMO-1026, Pacific Northwest Laboratory, Richland, Washington.

APPENDIX A  
WELL RESULT REPORT

9 2 1 2 5 5 1 0 0 5

5/05/92

Page 1

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL		CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value	
3-1-10	Chromium	PPB	10.0	2/24/87	<	10.0
				3/13/87		13.0
				4/29/87	<	10.0
				6/18/87	<	10.0
				8/19/87	<	10.0
				11/19/87	<	10.0
				5/26/88	<	10.0
				8/01/88	<	10.0
				12/09/88	<	10.0
				6/07/89	<	10.0
	Chromium, filtered	PPB	10.0	12/18/89	<	10.0
				7/15/91	U	20.0*
				12/06/91	U	20.0
				2/24/87	<	10.0
				3/13/87	<	10.0
				4/29/87	<	10.0
				6/18/87	<	10.0
				8/19/87	<	10.0
				11/19/87	<	10.0
				5/26/88	<	10.0
3-1-11	Chromium	PPB	10.0	8/01/88	<	10.0
				12/09/88	<	10.0
				6/07/89	<	10.0
				12/18/89	<	10.0
				12/06/91	U	20.0
				2/24/87	<	10.0
				3/17/87	<	10.0
				4/29/87	<	10.0
				6/30/87	<	10.0
				8/26/87		11.0
	Chromium, filtered	PPB	10.0	11/05/87	<	10.0
				5/17/88	<	10.0
				8/11/88	<	10.0
				12/07/88	<	10.0
				6/14/89	<	10.0
				12/19/89	<	10.0
				12/18/91		43.0
				2/24/87	<	10.0
				3/17/87	<	10.0
				4/29/87	<	10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

\* U 20 Indicates Undetectable Cr  
A-1

92120551396

5/05/92

Page 2

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-1-11	Chromium, filtered	PPB	10.0	6/30/87	< 10.0
				8/26/87	< 10.0
				10/08/87	< 10.0
				10/15/87	< 10.0
				10/22/87	< 10.0
				10/29/87	< 10.0
				11/05/87	< 10.0
				11/11/87	< 10.0
				11/18/87	< 10.0
				11/23/87	< 10.0
				12/03/87	< 10.0
				5/17/88	< 10.0
				8/11/88	< 10.0
				12/07/88	< 10.0
				6/14/89	< 10.0
				12/19/89	< 10.0
				12/18/91	U 20.0
3-1-12	Chromium	PPB	10.0	2/21/87	< 10.0
				3/13/87	< 10.0
				4/27/87	10.0
				6/18/87	< 10.0
				8/20/87	< 10.0
				11/11/87	< 10.0
				5/17/88	< 10.0
				8/04/88	< 10.0
				12/11/88	14.0
				6/02/89	12.0
				12/18/89	< 10.0
				7/18/91	21.0
				12/06/91	U 20.0
	Chromium, filtered	PPB	10.0	2/21/87	< 10.0
				3/13/87	< 10.0
				4/27/87	< 10.0
				6/18/87	< 10.0
				8/20/87	< 10.0
				11/11/87	< 10.0
				5/17/88	< 10.0
				8/04/88	< 10.0
				12/11/88	< 10.0
				6/02/89	< 10.0
				12/18/89	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

921265137

5/05/92

Page 3

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-1-12	Chromium, filtered	PPB	10.0	12/06/91	U 20.0
3-1-13	Chromium	PPB	10.0	2/27/87	16.0
				3/13/87	< 10.0
				4/27/87	< 10.0
				6/18/87	< 10.0
				8/25/87	12.0
				11/18/87	10.0
				5/27/88	< 10.0
				8/01/88	< 10.0
				12/11/88	< 10.0
				6/06/89	< 10.0
				12/18/89	< 10.0
				7/16/91	U 20.0
				12/11/91	U 20.0
	Chromium, filtered	PPB	10.0	2/27/87	< 10.0
				3/13/87	< 10.0
				4/27/87	< 10.0
				6/18/87	< 10.0
				8/25/87	< 10.0
				8/25/87	< 10.0
				11/18/87	< 10.0
				5/27/88	< 10.0
				5/27/88	< 10.0
				8/01/88	< 10.0
				8/01/88	< 10.0
				12/11/88	< 10.0
				6/06/89	< 10.0
				12/18/89	< 10.0
				7/16/91	U 20.0
				12/11/91	U 20.0
3-1-14	Chromium	PPB	10.0	2/21/87	< 10.0
				3/13/87	< 10.0
				4/29/87	< 10.0
				6/18/87	< 10.0
				8/25/87	13.0
				11/18/87	10.0
				5/26/88	< 10.0
				8/01/88	< 10.0
				12/09/88	< 10.0
				6/06/89	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

9212651313

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-1-14	Chromium	PPB	10.0	12/18/89	< 10.0
				7/16/91	U 20.0
				12/11/91	U 20.0
	Chromium, filtered	PPB	10.0	2/21/87	< 10.0
				3/13/87	< 10.0
				4/29/87	< 10.0
				6/18/87	< 10.0
				8/25/87	< 10.0
				11/18/87	< 10.0
				5/26/88	< 10.0
				8/01/88	< 10.0
				12/09/88	< 10.0
				6/06/89	< 10.0
				12/18/89	< 10.0
				7/16/91	U 20.0
				12/11/91	U 20.0
3-1-15	Chromium	PPB	10.0	2/21/87	< 10.0
				3/13/87	< 10.0
				4/27/87	< 10.0
				6/18/87	< 10.0
				8/19/87	< 10.0
				11/16/87	< 10.0
				5/26/88	< 10.0
				8/01/88	< 10.0
				12/12/88	< 10.0
				6/09/89	< 10.0
				6/09/89	< 10.0
				12/18/89	< 10.0
				7/16/91	U 20.0
				12/11/91	U 20.0
	Chromium, filtered	PPB	10.0	2/21/87	< 10.0
				3/13/87	< 10.0
				4/27/87	< 10.0
				6/18/87	< 10.0
				8/19/87	< 10.0
				11/16/87	< 10.0
				5/26/88	< 10.0
				8/01/88	< 10.0
				12/12/88	< 10.0
				6/09/89	< 10.0
				6/09/89	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

9212581879

5/05/92

Page 5

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-1-15	Chromium, filtered	PPB	10.0	12/18/89	< 10.0
				7/16/91	U 20.0
				12/11/91	U 20.0
3-1-16A	Chromium	PPB	10.0	3/23/87	< 10.0
				4/27/87	< 10.0
				6/05/87	< 10.0
				8/19/87	< 10.0
				11/16/87	11.0
				5/18/88	< 10.0
				8/02/88	< 10.0
				11/28/88	< 10.0
				12/06/88	< 10.0
				12/13/88	< 10.0
				1/13/89	< 10.0
				1/27/89	< 10.0
				6/07/89	< 10.0
				12/18/89	10.0
				7/11/91	U 20.0
	Chromium, filtered	PPB	10.0	12/06/91	U 20.0
				3/23/87	< 10.0
				4/27/87	< 10.0
				6/05/87	< 10.0
				8/19/87	< 10.0
				11/16/87	< 10.0
				5/18/88	< 10.0
				5/18/88	< 10.0
				8/02/88	< 10.0
				8/02/88	< 10.0
				11/28/88	< 10.0
				12/06/88	< 10.0
				12/13/88	< 10.0
				1/13/89	< 10.0
				1/27/89	< 10.0
				6/07/89	< 10.0
				12/18/89	< 10.0
				12/06/91	U 20.0
3-1-16B	Chromium	PPB	10.0	3/23/87	11.0
				4/24/87	14.0
				6/09/87	< 10.0
				8/19/87	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

9212651310

5/05/92

Page 6

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-1-16B	Chromium	PPB	10.0	11/16/87	10.0
				5/18/88	11.0
				8/02/88	< 10.0
				11/28/88	< 10.0
				12/06/88	< 10.0
				12/13/88	17.0
				1/13/89	< 10.0
				1/27/89	< 10.0
				6/07/89	< 10.0
				12/18/89	< 10.0
				7/11/91	U 20.0
				7/11/91	23.5
				12/06/91	41.0
	Chromium, filtered	PPB	10.0	3/23/87	< 10.0
				4/24/87	< 10.0
				6/09/87	< 10.0
				8/19/87	< 10.0
				11/16/87	< 10.0
				5/18/88	< 10.0
				8/02/88	< 10.0
				11/28/88	< 10.0
				12/06/88	< 10.0
				12/13/88	< 10.0
				1/13/89	< 10.0
				1/27/89	< 10.0
				6/07/89	< 10.0
				12/18/89	< 10.0
				12/06/91	U 20.0
3-1-17A	Chromium	PPB	10.0	2/27/87	< 10.0
				3/30/87	10.0
				4/23/87	< 10.0
				6/04/87	< 10.0
				8/20/87	< 10.0
				11/05/87	< 10.0
				5/20/88	< 10.0
				8/15/88	< 10.0
				12/07/88	< 10.0
				12/07/88	< 10.0
				6/05/89	< 10.0
				12/19/89	< 10.0
				7/11/91	U 20.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group



5/05/92

Page 7

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-1-17A	Chromium	PPB	10.0	12/10/91	U 20.0
	Chromium, filtered	PPB	10.0	2/27/87	< 10.0
				3/30/87	< 10.0
				4/23/87	< 10.0
				6/04/87	< 10.0
				8/20/87	< 10.0
				10/08/87	< 10.0
				10/15/87	< 10.0
				10/22/87	< 10.0
				10/29/87	< 10.0
				11/05/87	< 10.0
				11/11/87	< 10.0
				11/18/87	< 10.0
				11/23/87	< 10.0
				12/03/87	< 10.0
				5/20/88	< 10.0
				8/15/88	< 10.0
				12/07/88	< 10.0
				12/07/88	< 10.0
				6/05/89	< 10.0
				12/19/89	< 10.0
				12/10/91	U 20.0
3-1-17B	Chromium	PPB	10.0	3/30/87	13.0
				4/23/87	14.0
				6/05/87	19.0
				8/20/87	10.0
				11/05/87	14.0
				5/20/88	< 10.0
				8/15/88	< 10.0
				12/11/88	14.0
				6/05/89	< 10.0
				12/19/89	< 10.0
				7/11/91	U 20.0
				12/10/91	U 20.0
	Chromium, filtered	PPB	10.0	3/30/87	< 10.0
				4/23/87	< 10.0
				6/05/87	< 10.0
				8/20/87	< 10.0
				11/05/87	< 10.0
				5/20/88	< 10.0
				8/15/88	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

5/05/92

Page 8

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-1-17B	Chromium, filtered	PPB	10.0	12/11/88	< 10.0
				6/05/89	< 10.0
				12/19/89	< 10.0
				12/10/91	U 20.0
3-1-18A	Chromium	PPB	10.0	2/27/87	< 10.0
				3/31/87	< 10.0
				4/22/87	< 10.0
				6/18/87	< 10.0
				8/24/87	< 10.0
				11/17/87	17.0
				5/23/88	10.0
				8/16/88	< 10.0
				12/07/88	< 10.0
				6/08/89	< 10.0
	Chromium, filtered	PPB	10.0	12/18/89	< 10.0
				7/15/91	31.5
				12/13/91	30.0
				2/27/87	< 10.0
				3/31/87	< 10.0
				4/22/87	< 10.0
3-1-7	Chromium	PPB	10.0	6/18/87	< 10.0
				8/24/87	< 10.0
				11/17/87	< 10.0
				5/23/88	< 10.0
				8/16/88	< 10.0
				12/07/88	< 10.0
				6/08/89	< 10.0
				12/18/89	< 10.0
				12/13/91	U 20.0
				8/02/85	25.0
				8/23/85	13.0
				9/26/85	13.0
				10/25/85	< 10.0
				12/10/85	< 10.0
				1/14/86	< 10.0
				2/14/86	< 10.0
				3/18/86	< 10.0
				4/21/86	< 10.0
				5/20/86	< 10.0
				6/24/86	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

921203183

5/05/92

Page 9

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-1-7	Chromium	PPB	10.0	7/18/86	< 10.0
				8/18/86	< 10.0
				9/17/86	< 10.0
				10/28/86	< 10.0
				11/13/86	< 10.0
				12/10/86	< 10.0
				2/21/87	< 10.0
				3/25/87	< 10.0
				4/15/87	< 10.0
				6/19/87	< 10.0
				8/17/87	< 10.0
				11/13/87	< 10.0
				5/24/88	< 10.0
				8/03/88	< 10.0
				12/12/88	< 10.0
				12/12/88	< 10.0
				6/02/89	< 10.0
				11/21/89	< 10.0
				12/19/89	< 10.0
				12/19/89	< 10.0
				7/09/91	U 20.0
				12/16/91	73.0
	Chromium, filtered	PPB	10.0	10/28/86	< 10.0
				12/10/86	< 10.0
				8/17/87	< 10.0
				11/13/87	< 10.0
				5/24/88	< 10.0
				8/03/88	< 10.0
				12/12/88	< 10.0
				12/12/88	< 10.0
				6/02/89	< 10.0
				11/21/89	< 10.0
				12/19/89	< 10.0
				12/19/89	< 10.0
				7/09/91	U 20.0
				12/16/91	U 20.0
3-2-1	Chromium	PPB	10.0	6/17/85	< 10.0
				7/23/85	< 10.0
				8/20/85	< 10.0
				9/23/85	< 10.0
				10/30/85	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

9212351811

5/05/92

Page 10

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
	Name	Units	Detection Limit	Sample Date	Analysis Value
3-2-1	Chromium	PPB	10.0	12/05/85	< 10.0
				1/20/86	< 10.0
				2/21/86	< 10.0
				3/18/86	< 10.0
				4/22/86	< 10.0
				5/27/86	< 10.0
				6/18/86	< 10.0
				7/17/86	< 10.0
				8/22/86	< 10.0
				9/22/86	< 10.0
				10/21/86	< 10.0
				11/12/86	< 10.0
				12/08/86	< 10.0
				1/19/87	< 10.0
				2/19/87	< 10.0
				3/26/87	< 10.0
				4/21/87	< 10.0
				6/24/87	< 10.0
				8/14/87	< 10.0
				11/10/87	< 10.0
				5/24/88	< 10.0
				8/17/88	< 10.0
				12/11/88	< 10.0
				6/09/89	< 10.0
				12/19/89	< 10.0
	Chromium, filtered	PPB	10.0	7/09/91	U 20.0
				12/18/91	U 20.0
				9/22/86	< 10.0
				10/21/86	< 10.0
				11/12/86	< 10.0
				12/08/86	< 10.0
				1/19/87	< 10.0
				2/19/87	< 10.0
				3/26/87	< 10.0
				4/21/87	< 10.0
				6/24/87	< 10.0
				8/14/87	< 10.0
				11/10/87	< 10.0
				5/24/88	< 10.0
				8/17/88	< 10.0
				12/11/88	< 10.0
				6/09/89	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

921201518150

5/05/92

Page 11

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
	Name	Units	Detection Limit	Sample Date	Analysis Value
3-2-1	Chromium, filtered	PPB	10.0	12/19/89	< 10.0
				7/09/91	U 20.0
				12/18/91	U 20.0
3-3-10	Chromium	PPB	10.0	7/01/85	10.0
				7/01/85	< 10.0
				7/01/85	< 10.0
				7/01/85	< 10.0
				7/30/85	< 10.0
				7/30/85	< 10.0
				7/30/85	< 10.0
				7/30/85	38.0
				8/22/85	< 10.0
				8/22/85	< 10.0
				8/22/85	< 10.0
				8/22/85	< 10.0
				9/30/85	< 10.0
				10/23/85	< 10.0
				10/23/85	< 10.0
				11/21/85	< 10.0
				1/16/86	< 10.0
				2/19/86	< 10.0
				3/14/86	< 10.0
				4/17/86	< 10.0
				5/22/86	< 10.0
				6/23/86	< 10.0
				7/22/86	< 10.0
				8/29/86	< 10.0
				9/19/86	< 10.0
				10/22/86	< 10.0
				11/11/86	< 10.0
				12/09/86	< 10.0
				1/22/87	< 10.0
				2/03/87	< 10.0
				3/29/87	< 10.0
				4/14/87	< 10.0
				6/25/87	< 10.0
				8/13/87	< 10.0
				11/20/87	< 10.0
				5/09/88	< 10.0
				8/17/88	< 10.0
				12/09/88	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

921201316

5/05/92

Page 12

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-3-10	Chromium	PPB	10.0	6/02/89	< 10.0
				12/19/89	< 10.0
				7/12/91	U 20.0
				12/18/91	U 20.0
	Chromium, filtered	PPB	10.0	9/19/86	< 10.0
				10/22/86	< 10.0
				11/11/86	< 10.0
				12/09/86	< 10.0
				1/22/87	< 10.0
				2/03/87	< 10.0
				3/29/87	< 10.0
				4/14/87	< 10.0
				6/25/87	< 10.0
				8/13/87	< 10.0
				11/20/87	< 10.0
				5/07/88	< 10.0
				8/17/88	< 10.0
				12/09/88	< 10.0
				6/02/89	< 10.0
				12/19/89	< 10.0
				12/18/91	U 20.0
3-3-7	Chromium	PPB	10.0	6/25/85	< 10.0
				7/24/85	< 10.0
				8/20/85	< 10.0
				9/25/85	< 10.0
				10/28/85	< 10.0
				11/25/85	< 10.0
				1/17/86	< 10.0
				2/19/86	< 10.0
				3/14/86	< 10.0
				4/17/86	< 10.0
				5/19/86	< 10.0
				6/20/86	< 10.0
				7/17/86	< 10.0
				8/19/86	< 10.0
				9/19/86	< 10.0
				10/20/86	< 10.0
				11/10/86	< 10.0
				12/04/86	< 10.0
				1/19/87	< 10.0
				2/04/87	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

9212351317

5/05/92

Page 13

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
	Name	Units	Detection Limit	Sample Date	Analysis Value
3-3-7	Chromium	PPB	10.0	3/18/87	< 10.0
				4/28/87	< 10.0
				6/24/87	< 10.0
				8/13/87	< 10.0
				11/09/87	< 10.0
				5/27/88	< 10.0
				8/19/88	< 10.0
				12/08/88	< 10.0
				8/16/89	< 10.0
				8/16/89	< 10.0
				12/19/89	< 10.0
				7/12/91	30.0
				12/17/91	U 20.0
	Chromium, filtered	PPB	10.0	9/19/86	< 10.0
				10/20/86	< 10.0
				11/10/86	< 10.0
				12/04/86	< 10.0
				1/19/87	< 10.0
				2/04/87	< 10.0
				3/18/87	< 10.0
				4/28/87	< 10.0
				6/24/87	< 10.0
				8/13/87	< 10.0
				11/09/87	< 10.0
				5/27/88	< 10.0
3-3-9	Chromium	PPB	10.0	12/11/88	< 10.0
				6/12/89	< 10.0
				12/19/89	< 10.0
				7/15/91	U 20.0
				12/17/91	U 20.0
	Chromium, filtered	PPB	10.0	12/11/88	< 10.0
				6/12/89	< 10.0
				12/19/89	< 10.0
				7/15/91	U 20.0
				12/17/91	U 20.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

9212510

5/05/92

Page 14

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-4-1	Chromium	PPB	10.0	7/02/85	< 10.0
				7/23/85	< 10.0
				8/23/85	15.0
				9/24/85	< 10.0
				10/28/85	< 10.0
				12/06/85	< 10.0
				1/17/86	< 10.0
				2/18/86	< 10.0
				3/13/86	23.0
				4/18/86	< 10.0
				5/22/86	< 10.0
				6/23/86	< 10.0
				7/22/86	< 10.0
				8/27/86	< 10.0
				9/23/86	< 10.0
				10/23/86	< 10.0
				11/11/86	< 10.0
				12/09/86	< 10.0
				1/15/87	< 10.0
				2/23/87	< 10.0
				3/26/87	< 10.0
				4/21/87	< 10.0
				6/25/87	< 10.0
				8/13/87	< 10.0
				11/12/87	< 10.0
				5/27/88	< 10.0
				8/19/88	< 10.0
				12/21/88	< 10.0
				7/12/89	< 10.0
				12/20/89	< 10.0
				7/10/91	U 20.0
				12/10/91	U 20.0
	Chromium, filtered	PPB	10.0	9/23/86	< 10.0
				10/23/86	< 10.0
				11/11/86	< 10.0
				12/09/86	< 10.0
				1/15/87	< 10.0
				2/23/87	< 10.0
				3/26/87	< 10.0
				4/21/87	< 10.0
				6/25/87	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group



5/05/92

Page 15

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-4-1	Chromium, filtered	PPB	10.0	8/13/87	< 10.0
				11/12/87	< 10.0
				5/27/88	< 10.0
				8/19/88	< 10.0
				12/21/88	< 10.0
				7/12/89	< 10.0
				12/20/89	< 10.0
				7/10/91	U 20.0
				12/10/91	U 20.0
3-4-11	Chromium	PPB	10.0	2/24/87	17.0
				4/01/87	< 10.0
				4/23/87	< 10.0
				6/25/87	14.0
				8/26/87	< 10.0
				11/11/87	22.0
				5/25/88	< 10.0
				8/17/88	< 10.0
				12/15/88	< 10.0
				6/06/89	10.0
				12/20/89	< 10.0
				7/15/91	22.0
				12/11/91	22.0
	Chromium, filtered	PPB	10.0	2/24/87	< 10.0
				4/01/87	< 10.0
				4/23/87	< 10.0
				6/25/87	< 10.0
				8/26/87	< 10.0
				11/11/87	< 10.0
				5/25/88	< 10.0
				8/17/88	< 10.0
				12/15/88	< 10.0
				6/06/89	< 10.0
				12/20/89	< 10.0
				7/15/91	U 20.0
				12/11/91	U 20.0
3-4-7	Chromium	PPB	10.0	7/01/85	< 10.0
				7/01/85	< 10.0
				7/01/85	< 10.0
				7/01/85	28.0
				7/30/85	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

5/05/92

Page 16

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-4-7	Chromium	PPB	10.0	7/30/85	< 10.0
				7/30/85	< 10.0
				7/30/85	< 10.0
				8/22/85	< 10.0
				8/22/85	< 10.0
				8/22/85	< 10.0
				8/22/85	13.0
				9/25/85	< 10.0
				10/25/85	< 10.0
				10/25/85	< 10.0
				11/21/85	< 10.0
				1/16/86	< 10.0
				2/20/86	< 10.0
				3/13/86	< 10.0
				4/18/86	< 10.0
				5/22/86	< 10.0
				6/23/86	< 10.0
				7/18/86	< 10.0
				8/22/86	< 10.0
				9/19/86	< 10.0
				10/22/86	< 10.0
				11/10/86	< 10.0
				12/09/86	< 10.0
				1/22/87	< 10.0
				2/03/87	< 10.0
				3/18/87	< 10.0
				4/21/87	< 10.0
				6/25/87	< 10.0
				8/13/87	< 10.0
				11/06/87	< 10.0
				5/16/88	< 10.0
				8/17/88	< 10.0
				12/09/88	< 10.0
				6/13/89	< 10.0
				12/20/89	< 10.0
				7/09/91	U 20.0
				12/10/91	U 20.0
	Chromium, filtered	PPB	10.0	9/19/86	< 10.0
				10/22/86	< 10.0
				11/10/86	< 10.0
				12/09/86	< 10.0
				1/22/87	< 10.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

9212051821

5/05/92

Page 17

## Well Result Report

Chromium Result in Groundwater at the 300 Area Since 1/1/85

WELL	CONSTITUENT			RESULT	
Name	Name	Units	Detection Limit	Sample Date	Analysis Value
3-4-7	Chromium, filtered	PPB	10.0	2/03/87	< 10.0
				3/18/87	< 10.0
				4/21/87	< 10.0
				6/25/87	< 10.0
				8/13/87	< 10.0
				11/06/87	< 10.0
				5/16/88	< 10.0
				8/17/88	< 10.0
				12/09/88	< 10.0
				6/13/89	< 10.0
				12/20/89	< 10.0
				7/09/91	U 20.0
				12/10/91	U 20.0
3-8-1	Chromium	PPB	10.0	11/19/87	< 10.0
				5/10/88	< 10.0
				8/18/88	< 10.0
				12/09/88	13.0
				6/05/89	< 10.0
				12/20/89	< 10.0
				4/12/90	< 10.0
				7/15/91	U 20.0
				12/20/91	U 20.0
				12/20/91	U 20.0
				12/20/91	U 20.0
				12/20/91	U 20.0
	Chromium, filtered	PPB	10.0	11/19/87	< 10.0
				5/10/88	< 10.0
				8/18/88	< 10.0
				12/09/88	< 10.0
				6/05/89	< 10.0
				12/20/89	< 10.0
				4/12/90	< 10.0
				7/15/91	U 20.0

Note: Data are unofficial and should not be referenced without permission from the Geosciences Group

Date Received: <b>6/2/92</b>		<b>INFORMATION RELEASE REQUEST</b>		Reference: WHC-CM-3-4	
Complete for all Types of Release					
<b>Purpose</b> <input type="checkbox"/> Speech or Presentation <input type="checkbox"/> Full Paper <input type="checkbox"/> Summary <input type="checkbox"/> Abstract <input type="checkbox"/> Visual Aid <input type="checkbox"/> Speakers Bureau <input type="checkbox"/> Poster Session <input type="checkbox"/> Videotape			<input checked="" type="checkbox"/> Reference <input type="checkbox"/> Technical Report <input type="checkbox"/> Thesis or Dissertation <input type="checkbox"/> Manual <input type="checkbox"/> Brochure/Flier <input type="checkbox"/> Software/Database <input type="checkbox"/> Controlled Document <input type="checkbox"/> Other		
			ID Number (include revision, volume, etc.) <b>WHC-SD-EN-TI-039, Rev. Q</b>		
			List attachments.		
			Date Release Required <div style="text-align: center;"><b>June 28, 1992</b></div>		
Title <b>Evaluation of Hexavalent Chromium for 300-FF-1 and 300-FF-5 Operable Units</b>				Unclassified Category <b>UC-</b>	
				Impact Level <b>4</b>	
New or novel (patentable) subject matter? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If "Yes", has disclosure been submitted by WHC or other company? <input type="checkbox"/> No <input type="checkbox"/> Yes Disclosure No(s).			Information received from others in confidence, such as proprietary data, trade secrets, and/or inventions? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (Identify)		
Copyrights? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If "Yes", has written permission been granted? <input type="checkbox"/> No <input type="checkbox"/> Yes (Attach Permission)			Trademarks? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (Identify)		
Complete for Speech or Presentation					
Title of Conference or Meeting			Group or Society Sponsoring		
Date(s) of Conference or Meeting		City/State		Will proceedings be published? <input type="checkbox"/> Yes <input type="checkbox"/> No Will material be handed out? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Title of Journal					
CHECKLIST FOR SIGNATORIES					
Review Required per WHC-CM-3-4		Yes      No		Reviewer - Signature Indicates Approval	
				Name (printed)      Signature      Date	
Classification/Uncontrolled	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<div style="font-family: cursive; font-size: 1.2em;"> <b>SW BERGIN</b>      <i>Substantive</i>      6/2/92         </div>		
Nuclear Information	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Patent - General Counsel	<input checked="" type="checkbox"/>	<input type="checkbox"/>			
Legal - General Counsel	<input checked="" type="checkbox"/>	<input type="checkbox"/>			
Applied Technology/Export Controlled Information or International Program	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
WHC Program/Project	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Communications	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
RL Program/Project	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
Publication Services	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<div style="font-family: cursive; font-size: 1.2em;"> <b>L. Hermann for D.E.S.</b>      <i>L. Hermann</i>      6/18/92         </div>		
Other Program/Project	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Information conforms to all applicable requirements.      The above information is certified to be correct.					
References Available to Intended Audience <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		<b>INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP</b> Stamp is required before release. Release is contingent upon resolution of mandatory comments. <div style="border: 2px solid black; border-radius: 50%; padding: 10px; margin: 10px auto; width: 150px; text-align: center;">           APPROVED FOR RELEASE            OFFICIAL  <b>NS</b>            DOCUMENT            Date 6/18/92         </div>			
Transmit to DOE-HQ/Office of Scientific and Technical Information <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Author/Requestor (Printed/Signature)      Date					
<b>R. D. Belden</b> <i>R.D. Belden</i> 6/2/92					
Intended Audience <input type="checkbox"/> Internal <input type="checkbox"/> Sponsor <input checked="" type="checkbox"/> External					
Responsible Manager (Printed/Signature)      Date					
<b>R. A. Carlson</b> <i>RA Carlson</i> 6/2/92		Date Cancelled      Date Disapproved			

Date:  
6/26/92

## Evaluation of Hexavalent Chromium for 300-FF-1 and 300-FF-5 Operable Units

**ECN No.:**

Name	MSIN	With Attachment	EDT/ECN & Comment	EDT/ECN Only
R.D. Belden (15)	H4-55	X		
EDMC (2)	H4-22	X		
IRA Clearance	H4-17	X		
Central Files	L8-04	X		